IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	10/708,807	
Applicant	:	Christopher A. Tokarz, et al.	Confirmation No. 2806
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TC/A.U.	:	1742	
Examiner	:	Yee, Deborah	
Docket No.	:	018300-001349	
Customer No.	:	24,239	
Title	:	Thermomechanical Processing Routes in Compact Strip Production of High-Strength Low-Alloy Steel	

Commissioner for Patents
P.O. Box 1450
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DECLARATION OF ANTHONY J. DeARDO UNDER 37 C.F.R. § 1.132

Sir:

I, Anthony J. DeArdo, declare as follows:

1. I am a United States citizen and my domicile address is 1311 Fairstead Lane, Pittsburgh, Pennsylvania 15217.

2. I am a named inventor on the patent application referenced above.

3. I received my Doctorate of Philosophy (Materials Science and Engineering) from Carnegie Mellon University in May 1970, my Master of Science Degree in Materials Science and Engineering in May 1966 from Carnegie Mellon University, and my Bachelor of Science degree in Metallurgical Engineering in May

1965 from Drexel University.

4. I have been employed since 1975 by the University of Pittsburgh in the Department of Mechanical Engineering and Materials Science, attaining the positions of associate professor in 1977 and full professor in 1985. Since 1989, I have held the Whiteford Chair of Materials Science and Engineering. I also direct the Basic Metals Processing Research Institute within the Department of Mechanical Engineering and Materials Science.

5. Prior to joining the faculty at the University of Pittsburgh I was awarded the Gillette International Post-doctoral Fellowship and spent 1971 and 1972 at the University of Cambridge. In 1973-74 I was senior research metallurgist at the former Jones and Laughlin Steel Corporation.

6. I was elected Fellow of the Institute of Materials, London, in 1994 and Fellow of ASM International in 2000. I am also a member of the American Institute of Steel Technology, the Iron and Steel Society of AIME, and the Metallurgical Society of AIME.

7. My teaching includes mechanical and physical metallurgy with emphasis on the boundary between the two disciplines. Courses I teach include aspects of mechanical behavior of materials, the design of structural materials, annealing phenomena, formability, strengthening mechanisms, deformation processing, thermal treatments, mechanical properties and fracture.

8. I have developed numerous contacts with the global metallurgical industry, particularly in the areas of hot deformation of steel, microalloyed high strength low alloy (HSLA) steels and advanced high strength steels, which led to the

establishment of the Basic Metals Processing Research Institute.

9. I have authored and co-authored numerous papers on thermomechanical processing of microalloyed steel, some of which are listed on the page attached to this Declaration.

10. I have personal knowledge of the processes of grain refinement and recrystallization in the thermomechanical processing of microalloyed steel, and of the level of ordinary skill in the art of steel metallurgy and manufacturing, including but not limited to Compact Strip Production (CSP) of steel.

11. I have reviewed the patents cited by the Examiner in the Office Action dated August 24, 2006, namely US Patent No. 6,030,470 to Hensger et al. (the " '470 patent") and US Patent No. 6,231,696, also to Hensger et al. (the " '696 patent") (collectively, "the Hensger patents").

12. It is my professional opinion that the Hensger patents would not be enabling to one of ordinary skill in the art to practice the described processes and achieve "optimum mechanical properties" of the steel as required by the Hensger patents. '470 patent at col. 2, line 17; '696 patent at col. 1, lines 13-15. Nor would the Hensger patents be enabling to make steel having a substantially homogeneous ferrite microstructure. Further, one of ordinary skill in the art would not expect the Hensger patents' processes to work, and, in fact, the processes described in the Hensger patents will not work.

13. The deformations disclosed in the '470 patent at the first two roll stands are inadequate to result in improvement in the refinement and homogeneity of the grain structure in the steel. In the '470 patent the first roll stand, with a reduction of 50%, and

the second roll stand, with a reduction of 40%, both approximate conventional CSP roll forming deformations. *See* '470 patent col. 4, lines 6-13; Applicants' Table 1 and Table 2, Trial A for convention CSP deformations). Not only must there be an increase in interpass time downstream (the time between roll stands), but the reductions must increase over conventional amounts in order for there to be improved mechanical properties and grain refinement with homogeneity. Such a finding was a key part of Applicants' invention. The Hensger patents do not teach or suggest such a factor, and nor do they do so in combination with the knowledge of one of ordinary skill in the art.

14. Applicants' identify in the specification of our application a problem of coarse grain banded ferrite microstructure that reduces mechanical properties and leads to spurious nondestructive testing (NDT) readings. *See* ¶ 0031. This problem is addressed by refinement of coarse grained austenite. *See* ¶ 0032. One factor that assists in such refinement is rapid recrystallization kinetics, which may be brought about in part by increased driving force. *See* ¶ 33. The Hensger patents do not disclose a higher driving force or deformations at early rolls stands than conventional deformations, and do not disclose that their approach would lead to any benefit with respect to the banded microstructure/NDT area. Such an improvement would not be expected from the processes described in the Hensger patents.

15. Our invention results in a substantially homogeneous ferrite microstructure. Specifically, as shown in FIGS. 9 and 10 of our application, we made steel with a substantially homogeneous acicular ferrite microstructure. The Hensger patents do not make reference to acicular ferrite, and the methods disclosed therein would not result in the formation of acicular ferrite.

16. The rolling temperatures disclosed in the '470 patent are 1080°C at the first roll stand and 1030°C at the second roll stand. *See* '470 patent, col. 4, lines 6-13. One of ordinary skill in the art would recognize that the resulting recrystallized grain size would be much too large for improving the mechanical properties of the rolled steel. On the other hand, in our application we disclose temperatures at the first and second roll stands that are below 1000°C. This is a significant temperature difference, and one with which the teachings of the Hensger patents specifically conflict.

17. In addition, the Hensger patents require completion of recrystallization between the first deformation and the second deformation. For example, "during and/or after the first deformation a *complete* dynamic and/or meta-dynamic and/or static *recrystallization* of the casting structure *takes place prior to beginning the second deformation step.*" '470 patent, col. 2, lines 24-28 (emphasis added); *see also* '696 patent, claim 1, col. 4, lines 40-43. "It is important in accordance with the present invention that this *recrystallization is completely concluded* before the next deformation is carried out." *Id.* at col. 3, lines 4-7 (emphasis added). This is accomplished by taking a roll stand between the first and second deformations out of service. *See id.*, col. 4, lines 8-10.

18. In the examples given in our application, the time between the first two in service roll stands is inadequate to allow complete recrystallization. It is the interpass time between the second and fourth or fifth roll stand that is increased by taking the third or the third and fourth roll stands out of service. For example, in Table 2 of our application, Trial C has a time between stands F1 and F2 of 1.86 seconds, Trial D has a time of 2.08 seconds, and Trial E has a time of 2.48 seconds. The Hensger patents give

no indication of how long is required for complete recrystallization between its first two in service roll stands, but in our examples above, it is my professional opinion that while some recrystallization occurred, recrystallization was not complete at the second deformation (F2).

19. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

This 24th day of FEB, 2007.

Anthony J. DeArdo

Anthony J. DeArdo

Selected Papers of Dr. Anthony J. DeArdo

C. I. Garcia, C. Torkarz, C. Graham and A. J. DeArdo, "The Physical Metallurgy of HSLA Strip Steel Production Using the CSP Process," Proc. 2nd International Conference on Thermomechanical Processing of Steels, TMP'2004, June 15-17, Liege, Belgium, Ed. Centre de Recherches Metallurgiques, (Verlag Stahleisen GmbH, Dosseldolf, Germany, 2004), pp.173-179.

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C. I. Garcia, C. Torkaz, C. Graham, A. J. DeArdo, "Physical Metallurgy of High Strength Low Alloy Strip Steel Production Using Compact Strip Processing," Ironmaking and Steelmaking, vol. 32, no. 4, August, 2005, pp.314-318.

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